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The Effect of Mother's Voice, Music Voice and White Noise Methods on Pain and Physical Parameters during Venipuncture in Newborn: A Randomized Controlled Study

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ABSTRACT

Aim: The study was conducted to determine the effect of recorded mother's voice, music voice and white noise methods during the venipuncture procedure on pain level and physiological parameters in newborns.

Material and Methods: The study was a randomized controlled trial. The sample of the study consist of 80 newborns (recorded mother's voice group=20, music voice group=20, white noise=20, control group=20), according to the result of the power analysis. During the venipuncture process, the newborns in the experimental group were listened to the recorded mother's voice, music voice and white noise, while the newborns in the control group were only given routine venipuncture.

Results: When the research results were evaluated, it was determined that the pain levels of the newborns in the recorded mother's voice, music voice and white noise groups were significantly lower during and after the procedure compared to the control group ($p<0.05$). Pain levels of the recorded mother's voice group were significantly lower than those of the music voice and white noise ($p<0.05$). When the physiological parameter results were evaluated, it was determined that the most positive result in respiration values were in the white noise group ($p<0.05$).

Conclusion: It was observed that mother's voice, music voice and white noise methods are effective in reducing pain and regulating physiological parameter values during venipuncture in newborns. In line with these results, it is recommended that neonatal healthcare professionals use mother's voice, music sound, and white noise methods as non-pharmacological techniques.

Keywords: Mother's voice; music voice; newborn; pain; white noise.

Yenidoğanlara Venöz Kan Alma Girişimi Sırasında Dinletilen Anne Sesi, Müzik Sesi ve Beyaz Gürültünün Ağrı Düzeyi ve Fizyolojik Parametrelere Etkisi: Randomize Kontrollü Çalışma

ÖZ

Amaç: Araştırma, yenidoğanlara venöz kan alma girişimi sırasında dinletilen anne sesi, müzik sesi ve beyaz gürültü yöntemlerinin ağrı düzeyi ve fizyolojik parametrelere etkisini belirlemek amacı ile yapılmıştır.

Gereç ve Yöntemler: Araştırma randomize kontrollü deneysel çalışmadır. Araştırmanın örneklemini yapılan güç analizi sonucuna göre 80 yenidoğan (anne sesi grubu=20, müzik sesi grubu=20, beyaz gürültü=20, kontrol grubu=20) oluşturmuştur. Girişim grubundaki yenidoğanlara kan alma işlemi sırasında kayıtlı anne sesi, müzik sesi ve beyaz gürültü dinletilirken, kontrol grubundaki yenidoğanlara sadece rutin kan alma işlemi gerçekleştirilmiştir.

Bulgular: Araştırma sonuçları değerlendirildiğinde, kayıtlı anne sesi, müzik sesi ve beyaz gürültü gruplarındaki yenidoğanların işlem sırasında ve sonrasındaki ağrı düzeylerinin kontrol grubuna göre anlamlı derecede düşük olduğu belirlenmiştir ($p<0,05$). Anne sesi grubunun ağrı düzeyi, müzik sesi ve beyaz gürültü grubuna göre anlamlı derecede düşük bulunmuştur ($p<0,05$). Fizyolojik parametre sonuçları değerlendirildiğinde, solunum değerlerinde en olumlu sonucun beyaz gürültü grubunda olduğu belirlenmiştir ($p<0,05$).

Sonuç: Yenidoğanlarda kan alma girişimi sırasında oluşan ağrıyı azaltmada ve fizyolojik parametre değerlerini düzenlemede anne sesi, müzik sesi ve beyaz gürültü yöntemlerinin etkili olduğu görülmüştür. Bu sonuçlar doğrultusunda, yenidoğan sağlık çalışanlarının anne sesi, müzik sesi ve beyaz gürültüyü farmakolojik olmayan yöntemler olarak kullanması önerilmektedir.

Anahtar Kelimeler: Anne sesi; müzik sesi; yenidoğan; ağrı; beyaz gürültü.

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INTRODUCTION

Pain is among the most common symptoms during various medical interventions, especially in newborns and children (1-3). Newborns are exposed to various invasive procedures for diagnosis and treatment in neonatal intensive care units (NICU) (1,4). It was reported that newborns in the NICU were exposed to an average of 7.5-17.3 painful procedures per day. The most common procedures were heel lance, suctioning, venipuncture and insertion of peripheral venous catheter (4).

Newborns are vulnerable to neurodevelopmental changes from painful stimuli. Because the nervous system of the newborn is immature and undergoes significant developmental changes (5). Excess and long-term unrelieved pain can cause physiological, metabolic and psychological problems in the short and long term (5,6). Therefore, pain management of newborns is very important during invasive procedures (1,6).

Pharmacologic, non-pharmacologic or both methods are used in neonatal pain management (7-9). Non-pharmacological methods have benefits such as low cost, no side effects and increased the effects of analgesics or reduced the amount of their use (2,9,10). Studies report that non-pharmacological methods used during painful procedures, such as venipuncture, are very effective in relieving pain in newborns (1,3,7-9). Examples of non-pharmacological methods applied in newborns include kangaroo care, massage, swaddling, nonnutritive sucking, sweet solutions, breast feeding, fetal position, comforting, touching, aromatherapy, white noise, music sound, lullaby singing, mother and father's voice (3,10,11). Among these methods, auditory stimulants are highly effective as a cognitive strategy to reduce neonatal pain (7).

It is accepted that the fetus perceives sounds and reacts from the 26-28th week of gestational age (1,11). The fetus can recognize, perceive and respond to the mother's voice at 32 weeks of gestation (1,12). In recent years, there have been studies that the mother's voice is a benign stimulus that can stabilize the physiological state of the newborn, reduce the level of pain, improve the quality of sleep, accelerate the feeding process, and promote its growth and development (1,12-14). Other effective newborn sounds include white noise and music voice (3,8,9,11,15). White noise is likened to the sound in the mother’s womb because it is a continuously monotonous sound in the form of a hum (11). It was reported that white noise has a sedative effect, reduces pain and anxiety and also promotes growth and development of newborns (9,11). Since music has the power to trigger physiological responses, it causes a feeling of relaxation, increasing comfort, and reducing the perception of pain and anxiety (3,8,11,15).

In recent years, studies (1,7,8,9,11-15) have demonstrated the effectiveness of mother's voice, music voice and white noise in relieving pain in newborns. However, there are no comparative studies in the literature that provide data as to which one of the three methods is more effective on pain and physical parameters. Accordingly, this study was conducted to determine the effect of recorded mother's voice, music voice and white noise methods during the venipuncture procedure on pain level and physiological parameters in newborns.

MATERIAL AND METHODS

Study design

The study was conducted as a randomized controlled trial with a parallel design.

Participants and Setting

The population consisted of newborns who were admitted and treated in the Neonatal Intensive Care Unit of two university hospitals in Turkey. The sample was calculated with the Gpower 3.1 package program. The minimum number of newborns to be included per group was determined to be 17 newborns in each, with an effect size of 0.8, significance level of 0.05, and a power of 0.90. Considering possible drop-outs during the study, it was decided to include 20 newborns in each group. The study sample consisted of a total of 80 newborns who met the inclusion criteria. The inclusion criteria for the newborns were determined as being gestational aged between 37-41 weeks, birth weight of 2500 g and above, having no congenital or neurologic impairment; having no hearing loss or problem with ABR hearing test; being stable status of health, and undergoing venipuncture only once. The parents of the newborns gave written consent to participate in the study, as well.

Randomization

The newborns who participated in the study were divided into four groups by randomization method. Randomization was done by simple lottery method. While forming the groups, the parents of the newborns drew cards, and the newborns were randomly assigned to one of the study groups. A total of four-color cards (red, blue, yellow and green) were used during the draw lots. Red, blue, yellow and green cards (20 each) were placed in an invisible bag. The newborn with a red card was placed in the recorded mother's voice group, the newborn with a blue card was placed in the white noise group, the newborn with a yellow card was placed in the music voice group, and the newborn with a green card was placed in the control group. A CONSORT 2010 flow diagram of the study is shown in Figure 1.

Data collection instruments

Introductory Information Form

The introductory information form was developed by the researchers after a literature review (11,16). This form consists of questions about family and baby, including the newborn's date of birth, gestational week, gender, physical measurements, age and educational status of the parents.

Neonatal Infant Pain Scale

The Newborn Infant Pain Scale (NIPS) was developed by Lawrence et al in 1993 (17). Turkish validity and reliability were conducted by Akdovan and Yıldırım in 1999 (18). It is a scale that assesses the behavioral responses of preterm and term newborns to pain during interventional procedures. The six behavioural responses in the NIPS pain scale are facial expression, crying, arm and leg movements, alertness and breathing pattern. While two separate scores (0-1) are given for behaviors other than crying, three separate scores (0-1-2) are given

for crying. The total score ranges from 0 to 7, the higher the score, the more severe the pain. In the evaluation, 0-2 points indicate no pain; 3-4 points indicate mild, moderate pain, >4 points indicate severe pain (17,18).

Cronbach's alpha coefficient of NIPS was reported by Lawrence et al. (1993) as 0.95 before the procedure, 0.87 during the procedure and 0.88 after the procedure (17). Akdovan and Yıldırım (1999) found Cronbach's alpha coefficient between 0.83-0.86 (18). In this study, the Cronbach alpha coefficient of the scale was 0.91 before the procedure, 0.86 during the procedure and 0.81 after the procedure.

Physical Parameter Evaluation Form

This form was developed by the researchers as a result of the literature review (19,20). The form includes criteria to evaluate the physiological parameters of the newborn (oxygen saturation, pulse, temperature) before, during and after the procedure.

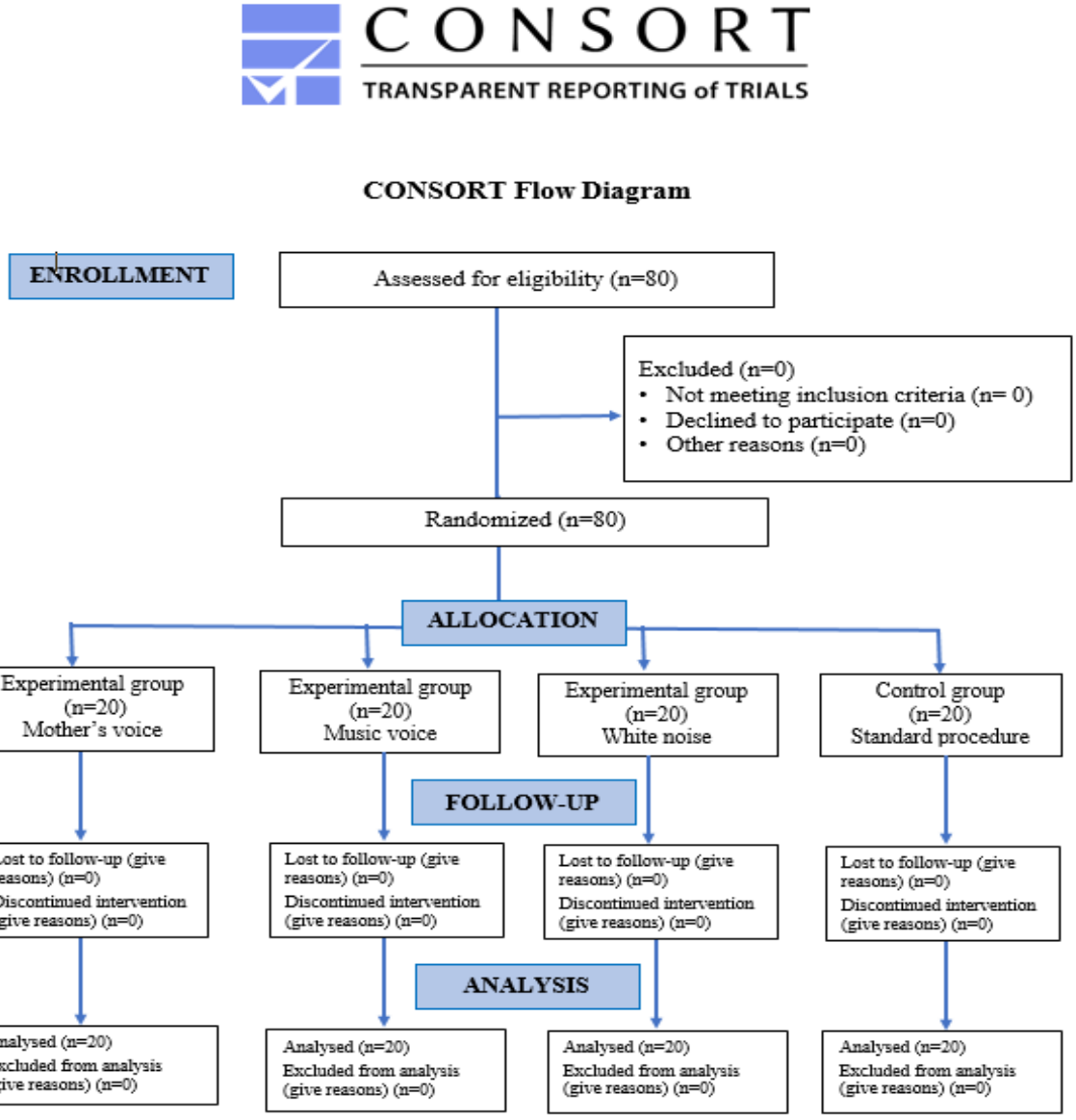

Figure 1. Consort flow diagram

Data Collection

During the data collection, the parents of the newborns who were admitted to the Neonatal Intensive Care Unit and met the inclusion criteria were informed about the study and provided their verbal and written consent. The researcher completed the "Introductory Information Form," by conducting face-to-face interviews with the parents of the newborns. Weight, height, head and chest circumference of the newborn were measured and recorded in the Introductory Information Form. The estimated time to complete the data collection tools was 15–20 min.

In the recorded mother's voice group, each newborn's own mother's voice was recorded on a voice recorder. In the music voice group, 'Mozart for Babies, Baby Music for Sleeping, Baby Songs' music was recorded on a voice recorder. The voice recorder with the mother's voice, music voice and white noise were played 50 cm away from

the newborn. The sound level for each newborn was determined as 55 decibels.

Procedure

Pain and physiological parameters of newborns were evaluated three times. The first evaluation was performed before the venipuncture procedure, the second evaluation was performed during the venipuncture procedure and the third evaluation was performed after the completion of the venipuncture procedure. Interventions of newborns were performed in the incubator.

In each of the four groups, pain level and physical parameter values of the newborns were measured and recorded before venipuncture procedure. After the first evaluation, the experimental groups newborn was allowed to listen to the mother's voice, music voice and white noise for two minutes (appropriate for their group). Experienced neonatal nurse performed the blood draw procedure in newborns. The venipuncture procedure was performed with needle number 21. The mother's voice, music and white noise continued to play during the procedure and until two minutes after the end of the procedure. The newborn in the control group received standard venipuncture procedures. The newborns in the control group were subjected to routine venipuncture procedures without any practice.

Statistical Analysis

The analyses of this study were conducted using the IBM SPSS Statistics 17 package program. Descriptive statistics of the continuous variables included in the study are expressed in mean, standard deviation, minimum, and maximum values, and descriptive statistics of categorical variables are expressed in frequency and percentage. When examining the differences between the groups, the Chi-Square test was used when examining the relationships between two independent categorical variables. Kolmogorov-Smirnov and Shapiro-Wilk's tests were used to determine whether the variables were normally distributed. When analyzing the intergroup differences, non-parametric Mann-Whitney U and Kruskal-Wallis-H tests were run in cases where the variables were not normally distributed. If significant differences were found in the Kruskal-Wallis-H test, the Post-Hoc Multiple Comparison Test was run to determine the groups between which a difference was obtained. When examining the differences between two dependent variables, the non-parametric Wilcoxon Test was run in cases where the variables were not normally distributed. When examining the differences between more than two dependent variables, the non-parametric Friedman's Two-Way ANOVA was run in cases where the variables were not normally distributed. The significance level was set at 0.05 (p-value) in statistical analyses.

Ethical Considerations

Written approval was obtained from the Non-Interventional Health Research Ethics Committee of a University to conduct the study (Decision No. 2017/141). Prior to the study, written permission was obtained from two university hospitals where the interventions would be performed. Since the answers should have been voluntarily given in all research for which data were gathered, the researcher attached importance to the

voluntary participation of the parents of the newborns included in the study. Furthermore, after the parents of the newborns were informed about the purpose of the study and the purposes for which the collected data would be used, they gave their consent (informed consent principle) verbally and in writing. The researcher followed the "principle of confidentiality" by explaining to the participants that their personal data would not be disclosed to others. Nurses and physicians working in the neonatal intensive care unit were informed about the purpose of the study and the data collection method.

RESULTS

Comparison of descriptive characteristics of newborns and parents

When the descriptive characteristics of the newborns were compared in terms of the groups in Table 1, no statistically significant difference was found between the groups in terms of the variables of gender, gestational age, weight, height, chest circumference and head circumference measurements ($p>0.05$), and they had homogeneous characteristics.

When the descriptive characteristics of the parents were compared in terms of the groups in Table 2, no statistically significant difference was found between the groups in terms of the variables of age and educational level ($p>0.05$), and they had homogeneous characteristics.

Comparison of pain values of newborns

When the mean scores of the NIPS used to assess the pain levels that the newborns were analyzed in Table 3, it was determined that there was no statistically significant difference between the experimental and control groups in terms of NIPS scores before the procedure ($p>0.05$), while there was a statistically significant difference in terms of NIPS scores during and after the procedure ($p=0.001$, Table 3). Accordingly, it was found that the mean NIPS scores of newborns in the control group during and after the procedure were significantly higher than the scores of newborns in all experimental groups. Moreover, it was found that the NIPS scores of the newborns in the recorded mother's voice group during the procedure (3.80±1.47) were significantly lower than the scores of the newborns in the music voice group (4.45±1.61), white noise group (4.65±1.87), and the control group (6.05±0.83). It was observed that the similar relationship between the groups continued after the procedure. It was found that the NIPS scores of the newborns in the recorded mother's voice group after the procedure (1.00±0.97) were significantly lower than the scores of the newborns in the music voice group (1.35±1.18), white noise group (2.35±2.08), and the control group (3.35±2.08).

Comparison of physiological parameter values of newborns

When the physical parameter values of the newborn included in the study were compared in Table 4, no statistically significant difference was found between the groups for the variable "heart rate, SPO2 and temperature" ($p>0.05$).

Table 1. Comparison of descriptive characteristics of the newborns in terms of the groups

	Mother's Voice (n=20)		Music Voice (n=20)		White Noise (n=20)		Control (n=20)			
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**H**	**p**
Gestation age (weeks)	37.70	1.42	37.60	1.43	37.8	1.54	37.65	1.67	1.102	0.777
Weight (g)	2971.50	327.85	3104.00	533.04	3204.00	520.25	3074.25	461.16	1.398	0.706
Height (cm)	47.70	2.25	47.40	4.32	49.15	2.66	48.05	3.17	2.992	0.393
Head circumference (cm)	33.90	0.97	33.35	2.23	34.55	1.55	33.40	1.93	4.451	0.217
Chest circumference (cm)	32.35	1.09	31.65	2.37	32.60	1.47	31.6	1.88	4.401	0.221
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**χ2**	**p**
Gender										
Female	7	35.0	9	45.0	8	40.0	8	40.0	0.417	0.937
Male	13	65.0	11	55.0	12	60.0	12	60.0		

H: Kruskal-Wallis-H test, χ2: Chi-Square test, SD: Standard deviation

Table 2. Comparison of descriptive characteristics of the parents in terms of the group

	Mother's Voice (n=20)		Music Voice (n=20)		White Noise (n=20)		Control (n=20)			
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**H**	**p**
Mother's Age	36.65	3.79	28.85	4.70	31.65	5.80	28.75	4.24	4.552	0.208
Father's Age	32.60	5.54	32.70	5.06	33.40	5.92	32.75	5.95	0.291	0.962
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**χ2**	**p**
Mother's Education										
Illiterate	1	5.0	1	5.0	0	0	0	0		
Primary School	2	10.0	3	15.0	7	35.0	2	10.0	-	0.299
Middle School	4	20.0	3	15.0	4	20.0	4	20.0		
High School	7	35.0	10	50.0	5	25.0	4	20.0		
University	6	30.0	3	15.0	4	0,0	9	45.0		
Master’s degree	0	0	0	0	0	0	1	5.0		
Father's Education										
Illiterate	0	0	0	0	0	0	0	0		
Primary School	4	20.0	6	30.0	5	25.0	4	20.0		
Middle School	6	30.0	4	20.0	4	20.0	3	15.0	-	0.939
High School	7	35.0	5	25.0	6	30.0	5	25.0		
University	3	15.0	5	25.0	5	25.0	7	35.0		
Master’s degree	0	0	0	0	0	0	1	5.0		

H: Kruskal-Wallis-H test, χ2: Chi-Square test, SD: Standard deviation

Although there was no statistically significant difference, it was observed that the heart rate and SPO2 values of the newborns in the experimental group were positively affected during and after the procedure compared to the control group. Furthermore, when the values of “respiration” were examined in the table, the respiration mean scores of the newborn in the white noise group during the procedure were significantly lower than those of the newborn in the recorded mother's voice, music voice and control groups ($p<0.05$).

Table 3. Comparison of NIPS scores according to groups and processing time

	Mother's Voice (n=20)		**Music Voice (n=20)**		**White Noise (n=20)**		**Control (n=20)**		**H**	**p**	**Difference**
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**			
NIPS											
Before procedure	0.35	0.93	1.30	1.78	1.15	1.76	1.30	2.03	7.271	0.064	-
During procedure	3.80	1.47	4.45	1.61	4.65	1.87	6.05	0.83	16.501	**0.001**	**1-2 1-3 2-4**
After procedure	1.00	0.97	1.35	1.18	2.35	2.08	3.35	2.08	20.323	**0.001**	**1-2 2-4 3-4**
	F=32.648 **p=0.001 Difference 1-2 1-3 2-3**		F=23.028 **p=0.001 Difference 1-2 2-3**		F=25.794 **p=0.001 Difference 1-2 1-3 2-3**		F=29.360 **p=0.001 Difference 1-2 1-3 2-3**				

H: Kruskal-Wallis-H test, F=Friedman test

Table 4. Comparison of physical parameter values according to groups and processing time

	Mother'sVoice (n=20)		**Music Voice (n=20)**		**White Noise (n=20)**		**Control (n=20)**		**H**	**p**	**Difference**
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**			
Heart rate											
Before procedure	132.45	23.50	137.00	26.82	143.80	20.01	136.30	18.46	4.737	0.192	-
During procedure	159.05	19.39	158.60	39.75	160.50	29.14	165.95	32.15	1.333	0.721	-
After procedure	150.40	18.53	147.85	24.15	157.05	27.17	150.05	32.78	2.961	0.398	-
	F=15.601 p=0.001 Difference 1-2 2-3		**F=15.367 p=0.001 Difference 1-2**		**F=15.474 p=0.001 Difference 1-2 1-3**		**F=9.564 p=0.008 Difference 1-2 2-3**				
Respiration											
Before procedure	47.45	3.27	44.00	3.93	43.75	4.79	43.80	6.49	8.784	0.032	**1-4 3-4**
During procedure	52.80	4.97	51.10	5.01	47.80	3.52	51.50	6.08	10.042	**0.018**	**1-3 3-4**
After procedure	47.00	4.77	47.25	6.44	48.10	4.76	50.70	5.78	4.86	**0.182**	-
	F=19.948 **p=0.001 Difference 1-2 2-3**		F=16.633 **p=0.001 Difference 1-2**		F=20.757 **p=0.001 Difference 1-2 1-3**		F=22.712 **p=0.001 Difference 1-2 1-3**				
SPO2											
Before procedure	98.90	10.685	96.05	5.44	96.90	5.15	96.10	3.92	11.274	**0.010**	**1-4 2-4**
During procedure	97.00	3.91	95.00	6.80	95.80	4.62	93.80	9.35	2.145	0.543	-
After procedure	98.20	2.42	97.45	2.39	96.25	4.31	95.05	5.84	2.207	0.581	-
	F=4.508 p=0.105 Difference -		F=0.636 p=0.727 Difference -		F=3.915 p=0.141 Difference -		F=2.545 p=0.281 Difference -				
Temperature											
Before procedure	37.05	0.10	36.96	0.41	37.13	0.46	37.00	0.48	1.259	0.739	-
During procedure	37.00	0.11	37.05	0.33	37.07	0.47	36.95	0.36	1.278	0.734	-
After procedure	36.99	0.11	36.95	0.52	37.09	0.53	36.96	0.46	1.727	0.621	-
	F=4.933 p=0.085 Difference -		F=0.655 p=0.721 Difference -		F=1.303 p=0.521 Difference -		F=0.471 p=0.791 Difference -				

H: Kruskal-Wallis-H test, F=Friedman test

DISCUSSION

In this study, it was aimed to determine the effect of recorded mother's voice, music voice and white noise methods during the venipuncture procedure on pain level and physiological parameters in newborns. Newborns respond to pain in three ways: physiologically, hormonally and behaviorally (21,22). The response of newborns to pain intensity is not quantitative data. Therefore, physiological and behavioral responses are most commonly considered in pain assessment (22,23). Physiological changes include heart rate, respiratory rate, blood pressure, oxygen saturation and body temperature. Behavioral changes include facial expressions, crying, gross motoric movements, behavioral and functional changes. These reactions to pain may differ from one newborn to another. The gestational age, gender, and physical measurements significantly affect the perception of and response to pain in newborns (11,22). In addition, the similarity of the characteristics of the parents in the groups reduces bias and increases the reliability of the study. When the descriptive characteristics of the newborns and their parents in the experimental and control groups were analyzed, no statistically significant difference was found between the groups ($p>0.05$) (Table 1, Table 2). This shows that the newborn and parents in the experimental and control groups had similar descriptive characteristics, which increased the reliability of the research by reducing bias. The similarity of the groups according to these variables, which have the potential to alter newborn's perception of pain and response levels, is important as it shows the effect of experimental and control groups on newborn's pain level and physiological parameters. In this study, homogeneity was ensured between the groups and the results of the research were not affected. Likewise, a review of the literature shows that the groups showed a similar distribution in terms of the descriptive characteristics of the groups and the descriptive characteristics of their parents in other similar experimental studies that were conducted to assess newborn's pain (1,7,11,20,24).

When the pain level of newborns before the procedure was examined in the study, there was no statistically significant difference between the groups in terms of NIPS scores and the groups were homogeneous ($p>0.05$, Table 3). Similarity of characteristics between groups increases the reliability of the study and reduces bias. In the study, when the pain levels of newborns were compared during and after the venipuncture procedure; it was determined that the pain level of newborns in the recorded mother's voice group was lower than the music voice, white noise and the control group, and the difference between them was found to be statistically significant ($p<0.05$, Table 3). These results show that newborns in the recorded mother's voice group experienced less pain than newborns in the music voice, white noise and control groups and that the mother's voice method was more effective in relieving pain. This situation may be explained by the fact that the mother-infant relationship begins in the prenatal period. It is known that the mother's voice with a thin tone is perceived more clearly in fetal life and is familiar to newborns after birth. It is thought that listening to this familiar sound to the newborn relaxes the baby, establishes a sense of trust, and reduces stress, thus reducing the effect of the pain produced by the venipuncture. When the literature is reviewed, other studies report similar results. Chen et al., (1) it was determined that the mean pain score of the mother's voice group was significantly lower than the routine care groups and concluded that mother's voice reduced pain caused by venipuncture in newborns. In the study of meta-analysis Ding et al., (13) it was found that mothers' voice could reduce pain levels during and until 10 min after painful procedures compared with routine care. In other studies, it was determined that the mother's voice newborns listened to during painful procedures decreased the pain level (12,25,26). The mother's voice was effective on pain level in other studies which support the result of this study.

When other findings in the study were examined, it was determined that the respiration values of the newborns in the white noise group were positively affected during the procedure ($p<0.05$). This can be explained by the fact that when the newborn hears the familiar sounds of intrauterine life, this relaxes the baby and has positive effects on respiratory values. When similar studies in the literature were examined, it was determined that the respiration rate of newborns who listened to the white noise was positively affected. In the study of meta-analysis Ye et al., (9) it was found that white noise could reduce respiratory values in painful procedures compared with routine care. In other studies, it was determined that the white noise newborns listened to during painful procedures had a positive effect on their respiratory values (20,24,27).

The advantages of this study are the use of a randomized controlled trial design and that it is the first study to compare three different methods (recorded mother's voice, music voice and white noise) during venipuncture procedure in newborns. However, this study has some limitations. Since the research was conducted with newborns, it cannot be generalized to children in other stages of development.

CONCLUSION

The results of the present study showed that recorded mother's voice, music voice and white noise methods applied to newborns during venipuncture procedures lowered pain levels and positively affected physical parameter values. Moreover, recorded mother's voice used as a non-pharmacological technique was a more effective method than music voice and white noise in reducing pain levels. Furthermore, it was determined that the most positive result in respiration values was in the white noise group.

Based on these results, it is recommended to include recorded mother's voice, music voice and white noise methods into nursing practices and care in order to lower the level of pain that develop during venipuncture procedures and to positively affect the physiological parameters of newborns. For an effective pain management in newborns, healthcare professionals should be trained, and the training should be repeated at certain times.

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